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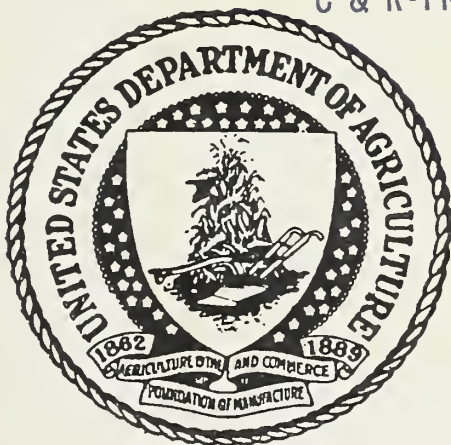
# Food Crops Utilization Research Laboratory

Weslaco, Texas

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Agricultural Research Service

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**UNITED STATES DEPARTMENT OF AGRICULTURE**  
**Agricultural Research Service**

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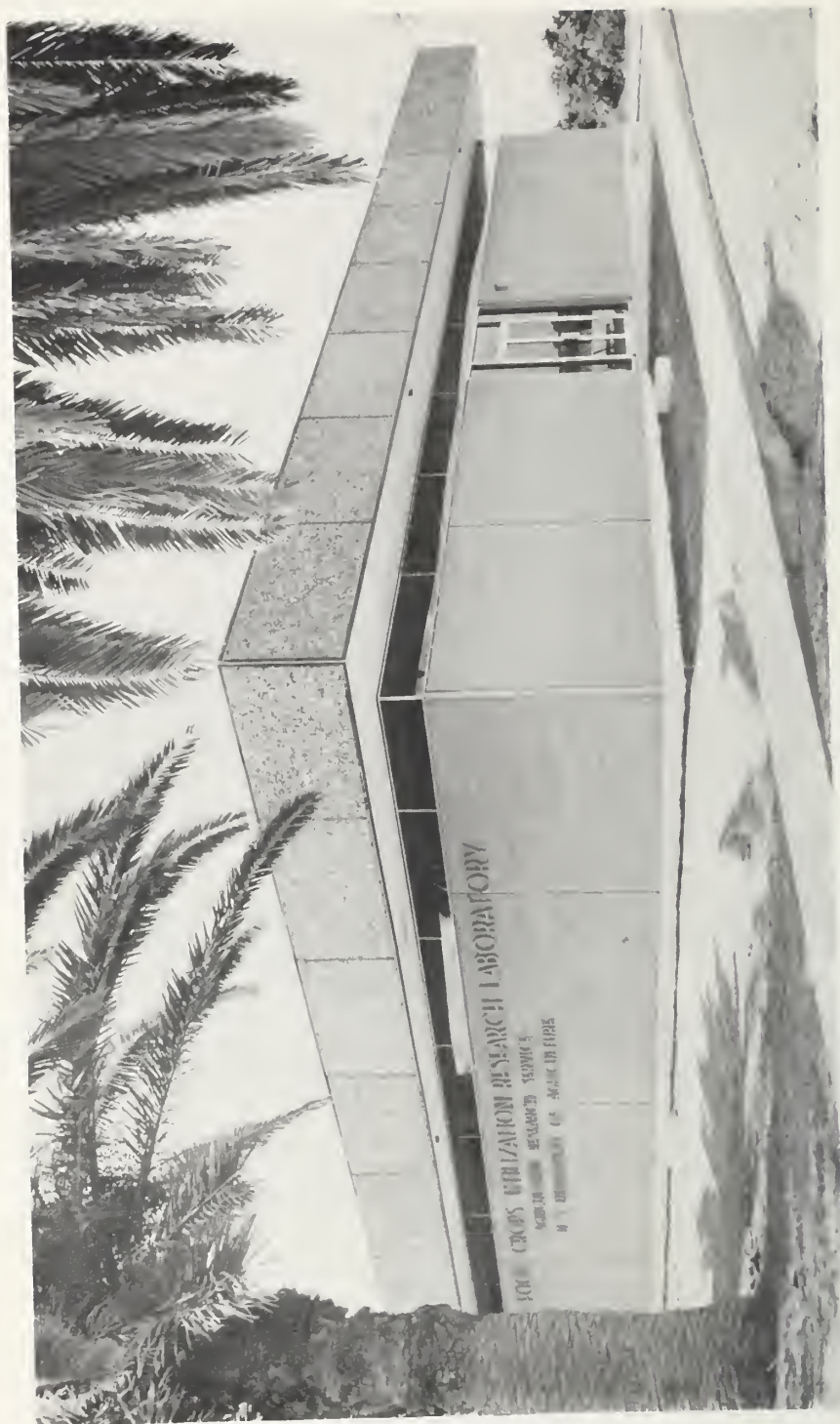
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**FOOD CROPS UTILIZATION RESEARCH LABORATORY**  
Weslaco, Texas

**F. P. GRIFFITHS**  
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October 1966



Food Crops Utilization Research Laboratory  
October 1966



## UTILIZATION RESEARCH

Utilization research as carried on by the U.S. Department of Agriculture employs the resources of modern science and technology to develop new and better products from agricultural crops. It serves consumers by meeting today's requirements for foods of higher quality and greater convenience. It also benefits farmers and processors by creating greater demand for their products.

The first coordinated nationwide program of utilization research was instituted by the Agricultural Adjustment Act of 1938, establishing Regional Research Laboratories to serve the four major farming areas of the United States. These Laboratories later became the principal laboratories and administrative headquarters for the Eastern, Northern, Southern, and Western Utilization Research and Development Divisions. They are administered by the Agricultural Research Service of USDA.

Before the opening of these Regional Laboratories the Department conducted utilization research in Washington, D. C., and in a number of small laboratories in the field, one of which was the Food Crops Utilization Research Laboratory.

This Laboratory was established in 1931 to aid in the development of the citrus processing industry and was called the Citrus Products Station. Later, it became the U. S. Fruit and Vegetable Products Laboratory. When activities were extended to include the chemistry of citrus and other fruits, and the chemistry and processing of vegetables and selected field crops, the present name, Food Crops Utilization Research Laboratory, was chosen to reflect this wider range of interest.

The Weslaco laboratory is part of the Southern Utilization Research and Development Division. Other laboratories in the Southern Division conducting research on fruits and vegetables are: the U. S. Fruit and Vegetable Products Laboratory, Winter Haven, Fla.; the U. S. Food Fermentation Laboratory, Raleigh, N. C.; and the Southern Regional Research Laboratory, New Orleans, La. USDA's Agricultural Research Service also has laboratories engaged in utilization research on fruits and vegetables at Albany and Pasadena, Calif., Puyallup, Wash., Honolulu, Hawaii, East Grand Forks, Minn., and Philadelphia, Pa. Weslaco scientists have access to the skills and facilities in these and other Agricultural Research laboratories to supplement their own.

## IDEAL LOCATION

The Food Crops Utilization Research Laboratory is part of an agricultural research complex in the southern tip of Texas, located on U. S. Highway 83, midway between the cities of Weslaco and Mercedes. It is situated in the heart of the Lower Rio Grande Valley, the Texas citrus-producing area, where the climate also favors production of avocados, papayas, and other subtropical fruits. This district, the nearby Winter Garden, Coastal Bend, and other vegetable-growing districts produce some 50 varieties of vegetables and related crops, ranging from anise to watermelons. Also available is a variety of field crops which may be investigated for potential new uses, including foods, feeds, and medicinal and industrial products. Thus the location of the Laboratory assures a continuous supply of freshly-harvested material for research.

## COOPERATIVE ACTIVITIES

The Laboratory cooperates with the Texas A&M University System Agricultural Experiment Station No. 15; Texas A&I College Citrus and Vegetable Training Center; U. S. Fruit, Vegetable, Soils and Water Research Laboratory; U. S. Processed Products Inspection Branch, Fruit and Vegetable Division; Rio Farms, Inc., a private foundation for agricultural research; and with industry and industry organizations. Several of these agencies seek to develop improved strains of fruits, vegetables, and field crops. Chemists and food technologists at the Food Crops Utilization Research Laboratory frequently aid by determining the processing characteristics of these experimental crops, so that work with only the promising varieties may be continued. In the Laboratory pilot plant they also test the applicability of conventional processing methods and make required adaptations, or try to develop new methods if this is necessary to obtain satisfactory products.



*Typical Chemistry Laboratory*

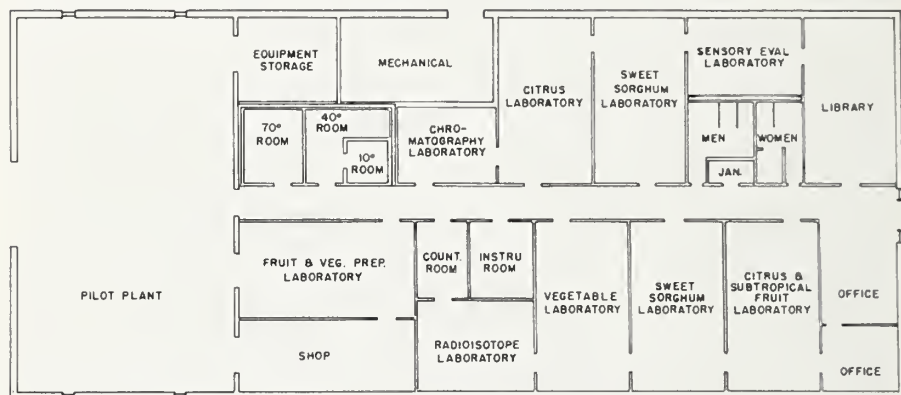
## PHYSICAL FACILITIES

Quarters for the Food Crops Utilization Research Laboratory have been designed specifically to meet the requirements of an institution devoted to the study of food chemistry and technology. There are five main laboratory rooms, one each for citrus, for citrus and subtropical fruits, and for vegetables, and two for sweet sorghum and field crops research. Any of these may be used for research on other commodities if this is desirable.

Other rooms are designed to provide the controlled environment necessary for the delicate instruments and techniques used in modern food research. One of these houses a gas chromatograph, spectrophotometer, and other instruments employed to separate and identify the many compounds that combine to give fruits and vegetables their

characteristic flavors, odors, and colors. Another contains radioisotope equipment for study of the formation and distribution of the chemical constituents in plant materials.

A sensory evaluation laboratory is ventilated with purified air and has special lighting and other accessories necessary for evaluation of the taste, odor, color and texture of new food products. Three refrigerated rooms with temperatures from 10°F. to 70°F. afford



*The floor plan of the laboratory building is laid out for maximum efficiency in the use of available space. The facilities provide for the more sophisticated research techniques, as well as for pilot plant tests of processes and products.*

facilities for low-temperature chemical experiments, and for tests to determine temperatures most suitable for storage of new food products.

The pilot plant area provides space for fruit and vegetable processing equipment used in the development of processes and the preparation of products on a scale between laboratory and commercial operations. There is also a reading room for the scientific book collection, administrative offices, a small machine shop and other facilities necessary to make a utilization research laboratory as versatile and self-sufficient as possible.



## CITRUS AND OTHER FRUITS

The Weslaco Laboratory is one of four within ARS for research on the chemistry and utilization of citrus. Because the Lower Rio Grande Valley of Texas is noted for its red grapefruit, much research emphasis has been placed on the processing of this fruit to take advantage of its attractive color and delicate flavor. The pigments responsible for its color have been the object of intensive study. The basic information gained should be applicable to pink and red grapefruit produced in other regions of the U. S. as well as to other crops in which the same pigments occur.

Investigation of flavor constituents, particularly those responsible for the bitter flavor in grapefruit, is being pursued vigorously. Increased knowledge about these compounds is essential to development of more acceptable grapefruit products.

There is also growing interest in the processing of some unusual varieties of citrus, particularly those resistant to freeze damage. Investigations of the chemistry and processing of avocados, papayas, and other fruits, will be related to the requirements of increasing production.

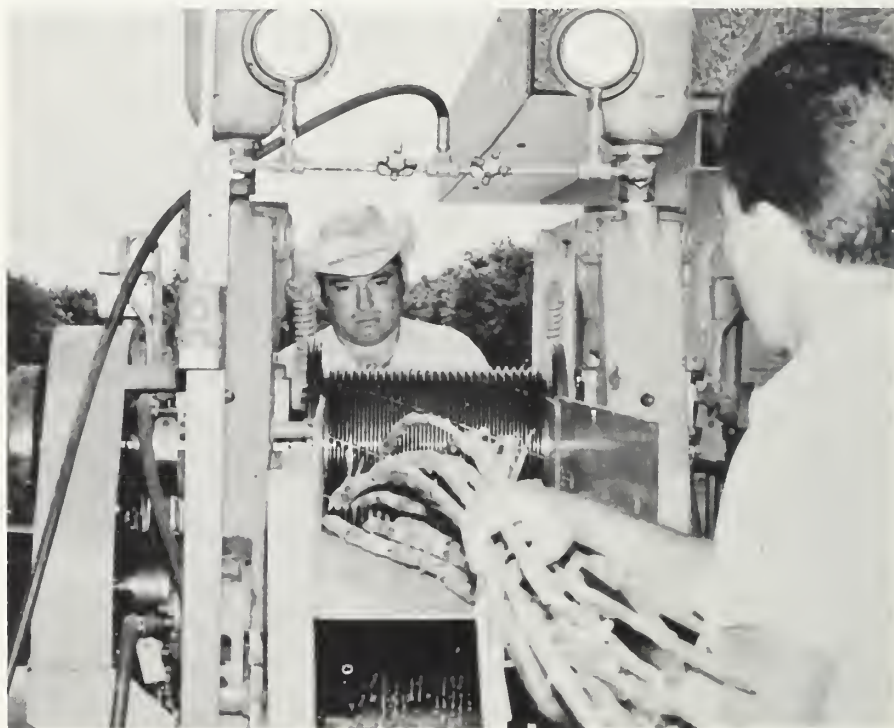


*Electronic Measurement of Grapefruit Color*

## VEGETABLES AND FIELD CROPS

About one-third of the vegetables produced in the United States are grown in the Southern region. Among the most important, from the standpoint of processing, are tomatoes, snap beans, and Southern peas. The Food Crops Utilization Research Laboratory staff has devoted considerable attention to methods to improve the color of tomato products, and the color and firmness of canned tomatoes. They have also developed methods to improve the quality of processed Southern peas, and to eliminate discoloration of canned beets. They have conducted limited research on carrots, snap beans, peppers, and squash. This work is part of a continuing research program to develop new and improved processed products from vegetables.

Research on utilization of sweet sorghum was started in 1964 at the request of industry seeking a diversification crop. Earlier efforts in cooperation with Texas A&M University and the Crops Research Division of the Agricultural Research Service were directed toward



*Extracting Juice from Sweet Sorghum*

selection of varieties suitable as sources of sugar. Utilization Research also has responsibility for developing sugar recovery processes and for integrating these processes with those for the manufacture of sugar from sugar beets and sugarcane.

## NEW TECHNOLOGY, NEW DEMANDS INCREASE NEED FOR RESEARCH

Whereas once fruits and vegetables were grown primarily for the fresh market, consumer demand for convenience and consistently high quality has resulted in a rising proportion of processed products. To meet this situation, the fiercely competitive food industry is taking advantage of the resources of a developing technology. There have been many innovations in food processing methods. Not all are new, but some are only recently finding commercial application and have possibilities for more extensive use. Among these are high-temperature short-time sterilization, aseptic canning, dehydro-freezing and canning, freeze-drying, vacuum drying, spray-drying, explosive puff drying, foam-mat drying, liquid nitrogen freezing, irradiation, pure-culture fermentation, use of oxygen and metal scavengers, formulations of sweeteners and various additives to provide selected taste and texture characteristics, alteration of physical and chemical characteristics by use of enzymes, deaeration, and packaging in inert gas. Other processing innovations are constantly being added to the list.

These technological advances offer virtually unlimited opportunities for research to develop new products from fruit, vegetables and field crops and to adapt new ideas and processes to their manufacture. The Food Crops Utilization Research Laboratory, together with other institutions of this kind has the responsibility for the application of these techniques, and in the development of new ones.

## RESEARCH AND INDUSTRY GROW TOGETHER

Expansion of research activities at the Food Crops Utilization Research Laboratory has been closely related to the growth of the food processing industry. When the Laboratory opened in 1931, Texas citrus production had reached a level where profitable use of fruit unsalable on the fresh market became essential. In Texas, California, and Florida there was great interest in processed products.

For the first decade staff members worked closely with industry on the development and introduction of methods of citrus processing, with emphasis on single-strength grapefruit juice. These researchers played a large part in the introduction of flash pasteurization, and assisted a courageous and enterprising group in establishing an industry. During this period they developed a method of measuring peel oil which the Agricultural Marketing Administration adopted officially for use in grading citrus juices. They also found that the heat pretreatment of grapefruit would enable processors to produce juice with an oil content low enough to meet Grade A standards. This method was used until improved extraction equipment became available.



*U. S. Citrus Products Station, 1931*



In the early 1930's staff members gave technical assistance in the sulfur dioxide preservation of grapefruit products for export to the United Kingdom. Because of this experience, during World War II the head of the Weslaco Laboratory was assigned as a leader in the preparation of millions of pounds of various fruits by this method for shipment to the United Kingdom.

Prior to World War II considerable information was developed on the freezing of vegetables, and during the war years on vegetable dehydration.

In the 1945-46 season, frozen orange concentrate from Florida reached the market, became an immediate success, and stimulated much interest in the possibilities of a comparable product from grapefruit. Investigations were undertaken by the Food Crops Utilization Research Laboratory, with the support and cooperation of the Texas Citrus Commission, to adapt the low-temperature evaporation and cut-back processes. Disastrous freezes in 1949 and again in 1951, however, virtually destroyed citrus plantings in the area and halted the work.

Pink grapefruit and the comparatively new red varieties were heavily favored by growers replacing lost trees. Processors antici-



*U. S. Fruit and Vegetable Products Laboratory, 1940*

pated a new problem in the canning of juice from the colored fruit and the Weslaco Laboratory undertook research to solve it. The scientists found they could improve juice color by adding back a portion of the pulp removed during finishing. They also demonstrated that the pulp from early-season, richly colored grapefruit could be preserved for addition to juice from late-season, poorly colored grapefruit.

Use of pulp-fortification in the preparation of frozen concentrate from pink and red grapefruit, and reduction of bitterness in grapefruit products by the use of enzymes are being investigated. Quality of the popular chilled citrus juices has been improved through stabilization by heat treatment. By using grapefruit juice as the major component in a mixture with juices from other fruits, an attractive fruit drink has been prepared.

The Laboratory has also developed a promising frozen salad base from avocados. Considerable work has been done on vegetable processing, leading to important contributions to improvement of canned tomatoes and tomato products, Southern peas, and other vegetables. These and other projects have been carried out in cooperation with an industry which is becoming increasingly quality-conscious, and with other agencies, both Federal and State, seeking to aid in the improvement of the fruit and vegetable processing industry.







